WHAT IS CLAIMED IS:

1. An aberration measuring apparatus comprising:

a converging lens disposed on the light path of light beam to converge light beam traveling through a measurement target optical system on a predetermined surface;

an aperture stop disposed on the light path of light beam to transmit a part of the light beam;

a moving unit connected the aperture stop to move said aperture stop within the light beam;

a converging position detection unit disposed on the predetermined surface to detect a positional deviation of a converging position of a part of the light beams traveling through said aperture stop on the predetermined surface; and

an arithmetic processing unit connected the converging position detection unit to calculate an aberration of said measurement target optical system on the basis of an output signal from said converging position detection unit.

2. An aberration measuring apparatus according to claim 1, wherein said converging lens converges a part of the light beams, and

said moving unit moves said converging lens integrally with said aperture stop in the direction intersecting the optical axis of the light beam.

3. An aberration measuring apparatus that measures an aberration of a projection optical system that transfers onto a substrate, an image of a predetermined circuit pattern formed on a mask, comprising:

an aberration measuring optical system disposed on the object plane side of the projection optical system to emit a light beam which measures the aberration upon said projection optical system;

a plurality of lens elements, two-dimensionally arrayed, disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system;

a converging position detection unit disposed on the image plane of the lens elements to detect each of positions of the light beams converged by said plurality of lens elements; and

a measuring device connected the converging position detection unit to measure the aberration of said projection optical system on the basis of the converged light positions detected by said converging position detection unit.

4. An aberration measuring apparatus according to claim 3, wherein said aberration measuring optical system includes:

a mask which measures the aberration, disposed

substantially in the same position as said mask formed with the predetermined circuit pattern is disposed and having a pinhole pattern; and

an illumination optical system that illuminates said mask which measures the aberration with the light beam.

5. An aberration measuring apparatus according to claim 4, wherein said illumination optical system is an illumination optical system that illuminates the predetermined circuit pattern with the light beam.

6. An aberration measuring method comprising:

converging light beam traveling through a measurement target optical system on a predetermined surface by the use of a converging lens;

making an aperture stop transmit a part of the light beam;

moving said aperture stop within the light beam;

detecting a positional deviation of each of a converging position of a part of the light beam traveling through said aperture stop on the predetermined surface by the use of a converging position detection unit; and

calculating an aberration of said measurement target optical system on the basis of an output signal obtained in said converging position detecting step.

7. An aberration measuring method according to claim 6, wherein a part of the light beam is converged in said converging step, and

said converging lens is moved integrally with said aperture stop in the direction intersecting the optical axis of the light beam in said moving step.

8. An aberration measuring method of measuring an aberration of a projection optical system that forms, on a substrate, an image of a predetermined circuit pattern formed on a mask through the projection optical system, comprising:

converging the light beams which measures the aberration that have passed through said projection optical system by the use of a plurality of lens elements;

detecting each of positions of the light beams converged by said plurality of lens elements; and

measuring the aberration of said projection optical system on the basis of the detected light positions.

9. An aberration measuring method according to claim 8, wherein the light beam which measures the aberration is light beam from a pinhole pattern on a mask, which measures the aberration, disposed substantially in the same position as the said mask is disposed.

10. A projection exposure apparatus comprising:

an illumination optical system which illuminates a predetermined circuit pattern with the light beam;

a projection optical system which forms the circuit pattern illuminated with the light beam on a substrate; and

an aberration measuring apparatus, claimed in claim 1, which measures an aberration of said projection optical system.

11. A projection exposure apparatus comprising:

an illumination optical system which illuminates a mask having a predetermined circuit pattern with the light beam;

a stage which supports said mask;

a projection optical system which forms on said substrate an image of the circuit pattern illuminated with the light beam; and

an aberration measuring apparatus, claimed in claim 1, which measures an aberration of said projection optical system,

wherein said stage or said mask has a generation member to generate light beam which measures the aberration of said projection optical system.

12. A projection exposure apparatus according to claim 11, wherein said generation member is a pinhole pattern which convert the light beam from said

illumination optical system into spherical waves.

13. A projection exposure apparatus according to claim 11, wherein said generation member is a transmission member which transmits in diffusion the light beam from said illumination optical system.

14. A projection exposure apparatus having a projection optical system which transfers onto a substrate an image of a circuit pattern formed in a mask, comprising:

an aberration measuring optical system disposed on an image plane side of the projection optical system to emit a light beam which measure the aberration upon said projection optical system;

a lens array elements disposed on an image plane side of the projection optical system to converge the light beams which measure the aberration through said projection optical system; and

a converging position detection unit adapted to the lens element to detect each of positions of the light beams converged by said lens array.

15. A projection exposure apparatus according to claim 14, wherein said aberration measuring optical system includes:

a mask which measures the aberration, disposed

substantially in the same position as said mask formed with the predetermined circuit pattern is disposed and having a pinhole pattern; and

an illumination optical system which illuminates said mask which measures the aberration with the light beam.

16. A projection exposure apparatus according to claim 14, further comprising a control unit connected the converging position detection unit to control a position of at least one of optical members constituting said projection optical system on the basis of a detected result given from said converging position detection unit.

17. A projection exposure apparatus according to claim 14, further comprising a substrate stage which holdes said substrate,

wherein at least said lens array or said converging position detection unit is detachably provided on said substrate stage.

18. A device manufacturing method, comprising:

measuring an aberration of said projection optical system by the use of said aberration measuring method claimed in claim 6; and

transferring an image of a predetermined circuit

pattern onto a substrate by the use of a projection optical system.

19. A device manufacturing method, comprising:

measuring an aberration of said projection optical system by the use of said aberration measuring method claimed in claim 8; and

transferring an image of a predetermined circuit pattern onto a substrate by the use of a projection optical system.

20. An exposure method comprising:

exposing a substrate to the light beam of a predetermined circuit pattern in a way of projecting the circuit pattern on said substrate by the use of said projection exposure apparatus claimed in claim 11.

21. An exposure method for transferring onto a substrate an image of a predetermined circuit pattern by the use of a projection optical system, comprising:

making light beam which measures an aberration incident upon said projection optical system before transferring the circuit pattern onto said substrate;

converging the light beam which measures the aberration that have passed through said projection optical system by the use of a plurality of lens elements two-dimensionally arrayed;

detecting each of positions of the light beams converged by said plurality of lens elements;

measuring the aberration of said projection optical system on the basis of the detected positions of the light beams; and

correcting the aberration of said projection optical system on the basis of the measured aberration.

22. An exposure method according to claim 21, wherein the aberration is a wavefront aberration of said projection optical system.

23. An exposure apparatus comprising:

a projection optical system which transfers onto a substrate an image of a pattern formed on a mask:

a holding mechanism adapted to a exposure apparatus body to detachably hold said aberration measuring apparatus claimed in claim 3.

24. An exposure apparatus according to claim 23, wherein said holding mechanism includes:

a first holding member which holds an aberration measuring optical system; and

a second holding member which holds a measuring unit having a plurality of lens elements, a converging position detection unit and a measuring device.

25. An exposure apparatus according to claim 24, wherein said first holding member is a mask stage which holds said mask, and

said second holding member is a substrate stage which holds said substrate.

26. An exposure apparatus according to claim 24, wherein said aberration measuring optical system is a mask for measurement, formed with a pinhole pattern which measures the aberration.

27. An aberration measuring apparatus that measures an aberration of a projection optical system which transfers onto a substrate an image of a pattern formed on a mask, comprising:

a measuring unit detachably provided on an exposure apparatus including a mask stage which holds said mask, said projection optical system, and a substrate stage which holds said substrate,

wherein said measuring unit includes:

a plurality of lens elements, two-dimensionally arrayed, disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system;

a converging position detection unit disposed on the image plane of the lens elements

to detect each of positions of the light beams converged by said plurality of lens elements; and

a measuring device connected the converging position detection unit to measure the aberration of said projection optical system on the basis of the light positions detected by said converging position detection unit.

28. An aberration measuring apparatus according to claim 27, further comprising an aberration measuring optical system through which the light beam which measures the aberration fall on said projection optical system,

wherein said measuring unit is detachably held on said substrate stage, and

said aberration measuring optical system is provided on said mask stage.

29. An aberration measuring method which measures an aberration of a projection optical system incorporated into an exposure apparatus which transfers onto a substrate an image of a pattern formed on a mask, comprising:

disposing an aberration measuring optical system, to emits a light beam which measures the aberration upon said projection optical system, substantially in the same position as said mask is disposed; and

attaching, to a substrate stage which holds said substrate, a measuring unit including:

a plurality of lens elements disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system; a converging position detection unit disposed on the image plane of the lens elements to detect each of positions of the light beams converged by said lens array ; and a measuring device connected the converging position detection unit to measure the aberration of said projection optical system on the basis of the light beam positions detected by said converging position detection unit.

30. An aberration measuring method according to claim 29, further comprising:

removing said aberration measuring optical system after the light beam which measures the aberration have fallen upon said projection optical system; and

removing said measuring unit from said substrate stage after measuring the aberration of said projection optical system.

31. An exposure method which transfers onto a substrate an image of a predetermined circuit pattern by the use of a projection optical system, comprising:

measuring an aberration of said projection optical system by the use of said aberration measuring method claimed in claim 29 before transferring the circuit pattern onto said substrate.

32. A device manufacturing method, comprising:

transferring onto a substrate an image of a predetermined circuit pattern by the use of a projection optical system,

measuring an aberration of said projection optical system by the use of said aberration measuring method claimed in claim 29 before transferring the circuit pattern onto said substrate.

33. An aberration measuring method according to claim 8, further comprising a step for correcting the measured aberration of said projection optical system.

34. A device manufacturing method according to claim 19, further comprising a step for correcting the aberration of said projection optical system on the basis of a measured result.

35. An aberration measuring apparatus which measures an aberration of a projection optical system which transfers onto a substrate an image of a pattern formed on a mask, comprising:

a measuring unit detachably provided on an exposure apparatus including a mask stage which holds said mask, said projection optical system, and a substrate stage which holds said substrate,

wherein said measuring unit includes:

a plurality of lens elements, two-dimensionally disposed, disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system;

a converging position detection unit disposed on the image plane of the lens elements to detect each of positions of the light beams converged by said plurality of lens elements; and

an output unit which outputs a result of the detection by said converging position detection unit to a correcting mechanism for correcting the aberration of said projection optical system.